

## **ABSTRACT**

The present invention is directed to systems and methods for all-frequency relighting by representing low frequencies of lighting with spherical harmonics and approximate the residual high-frequency energy with point lights. One such embodiment renders low-frequencies with a precomputed radiance transfer (PRT) technique (which requires only a moderate amount of precomputation and storage), while the higher-frequencies are rendered with on-the-fly techniques such as shadow maps and shadow volumes.

In addition, various embodiments are directed to a systems and methods for decomposing the lighting into harmonics and sets of point lights. Various alternative embodiments are directed to systems and methods for characterizing the types of environments for which the described decomposition is a viable technique in terms of speed (efficiency) versus quality (realism).